An Address ON THE WORK OF THE NATIONAL MEDICAL RESEARCH COMMITTEE.*

BY
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GENTLEMEN,—To dwell upon the large and profound changes which, even in my lifetime, have transformed the art and science of medicine would make a long story. But if, as you were good enough to suggest, I offer you some brief narration of the establishment and work of the National Medical Research Council and Committee, I shall illustrate thereby certain chief features of the new development. When some of us were consulted, not on the creation or management of a National Health Insurance but on certain of the scientific bearings and effects of the measure, we were rejoiced to find in the Minister who introduced it a far-seeing conviction of the opportunities of the Act for rekindling, reinforcing, and expanding that newer and wider life of medicine of which I have spoken.

The new life of medicine consists mainly in the advance from methods of description only to methods of description and analysis, an advance which, if pre-eminent in our own day, did not, of course, arise with us. This advance may be illustrated by the like reanimation of the methods of "natural history" by those of biology. By analysis we penetrate, below our observation of superficial likenesses and unlikenesses, to a closer and more experimental recognition of deeper affinities. In this way we attain to larger and more subtle appreciations of biological series, and so of causes, both proximate and remote. This movement, elaborate and exacting as its claims may be, is not only of infinite value in the functions of medicine, but indeed is of the essence of all technical art. The remonstrance, still not infrequently heard, that fiddling with instruments of precision is blinding us, or narrowing our view, on the side of clinical description, seems to me to have in it but little, if any, justice. Pedants there have been in all times and in all callings, but surely we, who champion scientific medicine and the establishment of quantitative upon qualitative methods, may ask in reply how it was that it remained for the recent scientific phase of medical history to distinguish clinically such maladies as those depending upon excess or defect of thyroid efficiency, many of those depending upon the chromaffin system, the two series of symptoms but lately distinguished as typhus and enteric fever; and so forth: distinctions open to the naked clinical eye but which nevertheless awaited the acumen of physicians of our day. At the same time, true it is that the arming of the naked clinical eye with instrumental means of observation, and, in therapeutics, the addition to our means of large and costly plants furnished in great part by the applications of modern physical science, have made what we call general practice, if it is to depend on the unaided labours of the individual practitioner, so exacting in time and skill as to be almost impossible. Yet, after all, personality goes, and must go, for as much as ever it did. How then are we to get over this problem of piling ever new claims upon the time and skill of the family physician with an abiding regard for the personal relations between doctor and patient? The sick man will resent, and reasonably resent, being deprived of these intimate and human relations of acquaintance and sympathy, and being committed to the colder benefits of a repairing manufactory. His malady would have no beginning and no history; the several specialistic interviews would be as pearls without a string. No machinery can make us forget the incalculable influences of the family physician; his intimacy with the earlier and later history of his patient, and the phases of his case; his wise friendship in times of personal suffering and family trial, his sagacious hopes and encouragements. All these and such influences are of the essence of cure.

Now, I repeat, is this dilemma of pathological elaboration on the one hand and personal co-operation and

sympathy on the other to be solved? First, by continual increase of the public, impersonal, preventive, side of medicine; secondly, by organized research to provide for the medicine of the future; thirdly, by arming the family physician with every reasonable resource of laboratory and consultative assistance which he may need.

Now during the last fifty years preventive medicine, in the State and Municipal sense—Public Medicine, as we call it—has made a considerable growth. The salaries of medical officers of health in all ranks of the service are too poor, and their increases during individual service too small, too capricious, too subject to illiberal local wrangling, and again the professional prizes too few, to attract the ablest men into public medicine. The lawyers who draft Acts of Parliament secure for their own profession—as county court judges, stipendiary magistrates, and the like, spheres of work certainly of not greater importance or difficulty—salaries and pensions of twice the amount, and protected against factious carping and paring. Still, under many disadvantages, and largely by the unrewarded public spirit of medical men, our system of public medicine is on the whole being fairly and soundly built. As regards our third requirement, the establishment throughout Great Britain of clinical laboratories, such as to be within the reach, and equal to the needs, of general practitioners in all districts, save perhaps the most remote, a provision I have fervently advocated for many years, our progress has been very tardy and imperfect. It is true the increase of the few university and municipal laboratories has done something for this end, but locally, incidentally, and fitfully. It is an open secret that Mr. Lloyd George, with his usual sagacity and ardour, not only saw this lack very clearly, but also was working out certain comprehensive schemes to supply it, when the calamity of the great war crushed this and many another, beneficent project. Happily, before the war there was just time to establish the second of the institutes of which I have spoken; namely, an organ of research, a systematic means of investigating disease with a view to the greater medicine of the future. To carry all the opportunities of the realized medicine of to-day to every considerable district in Great Britain will be a more costly adventure; it will mean not only the positively large, if relatively small, outlay of £120,000 a year at least, but it will be necessary also to train up for this function a school of peculiarly equipped clinical pathologists.

However, to establish and continue a school of medical research, an annual grant of about £60,000 was set apart for the Research Committee; although national adversities have since cut down some of the revenue of the Committee, and many of the proposals for expending it profitably. On the other hand, it was fortunate that before the war the Committee, under the able direction of Lord Moulton, had so far appointed the staff and organized its duties that, on the outbreak of it, the Committee was enabled to offer much assistance to the Medical Department of the War Office. As the Minister felt assured that there would be no difference of opinion in the Advisory Council as to the devotion of all the resources of the research organization to the service of the war he did not think it necessary at a time of strain to call a special meeting of the Council. And I may venture to add that Sir Alfred Keogh, Director-General A.M.S., has more than once made generous acknowledgement of the assistance of the Committee, which in its turn has to express to him its gratitude for much encouragement and many advantages. Of the surgical researches of Sir Almroth Wright in certain military hospitals this audience is no doubt well aware. And happily the duty of the Committee and the furtherance of its special purposes have not been divided. We now recognize that the occasions and events of the war have given opportunities for disciplined study and for consistent and extensive observation such as to have carried forward research in certain subjects towards results which in time of peace would have been obtained far more slowly, if at all.

I need not take up your time with the details of the initiation of the Research Council and Committee, nor of the conditions and instructions thereupon; I will quote parts of one sentence only: "the field of research is not limited, and is to . . . include . . . all researches bearing on health and disease, whether or not such researches have any direct or immediate bearing on any particular disease or class of diseases"; and so on. That is to say,

* Read at the annual meeting of the North Staffordshire Medical Society.

the work of the research authority is to be directed not only to temporary utilities but also to the creation of the medicine of the future.

And we have for the Advisory Council and the Committee even a wider ambition than this. Gradually, as it wins the confidence of the world of medical science, not by drill nor by the thralldoms of a formal institution, but by the natural ascendancy of merit, by first-rate thinking and achievement, it should lead, concentrate, and inspire the manifold activities of medical research throughout the kingdom.

The first question of means which we had to decide was whether we should use our grants to co-ordinate, to strengthen, and to fertilize the many and various places of research in the universities and technical schools of Great Britain, or should devote the whole of our resources to the creation of a large and wholly independent research factory in London. My own prepossessions were in favour of the former alternative, others of us leaned to the latter. On both sides there was much to be said; more than I can now repeat or fully indicate. But upon certain arguments in favour of at least some kind of central hospital for research I may touch briefly, arguments which, indeed, had led us ten years ago in Cambridge to establish a research hospital independent of the Addenbrooke's—namely, that in a general hospital a certain routine of daily management is hardly variable; also that patients must be discharged, or allowed to come and go, independently of any courses of observation and experiment; and again that even in chronic cases they must be submitted to immediate and continuous therapeutic and other technical interferences which baffle the stricter methods of research. Furthermore, in chemical and other problems of medical research, the services of experts of various orders, who are not on the staffs of general hospitals, are continually called for; moreover the intricacy of research funds with charitable funds would be more or less inextricable. Here and there, as at St. Mary's, a hospital may be able wholly to surrender a couple of wards for research purposes, and to place them at the disposal of an independent research staff not primarily concerned with healing the inmates; but few hospitals have the room or the conveniences to admit such a rule within a rule. In a research hospital the system and conditions of admission are so drawn up as to avoid these perplexities.

One more argument I will quote—namely, that the miscellaneous mass of research reported and collected from all parts must, if any clear, consistent, and permanent results are to come of it, be revised, appreciated, and controlled by experts of the highest competence, such as those we have secured; and these controllers must obviously have a house and laboratories of their own. For these reasons, and some others, it was decided by the Committee and the Advisory Council to divide the grant and to devote so much of it to a central department in London as would not cripple its means of subsidy for research elsewhere. For this end the hospital at Mount Vernon, a building well suited to the purpose, was purchased. Thus a portion of the grant was set apart for a comparatively small but highly efficient central research hospital where certain scheduled diseases could be studied intensely and controls carried out, and the rest devoted to inspiring, strengthening, and extending research in all and any of those institutions throughout Great Britain which should satisfy the Committee of full competence for the work. All the larger and more important of these centres have been visited more than once by members of the Committee, and consultations held with their chiefs. In every centre the proposals of the Committee have been cordially received, while on the other hand the Committee in its turn has received much valuable aid and information.

The Statistical Department must of course necessarily be centralized.

The names and distinctions of all the senior and of many of the junior staffs are probably well known to you, and justify themselves. The hospital at Mount Vernon, purchased by the Committee for its central clinical and laboratory research, has since been required by the War Office, and the military medical staff there is now engaged in the investigation of the cases which I may equivocally allude to as the "soldier's heart"; Sir William Osler, Sir James Mackenzie, and myself being the consulting officers.

Much good work on these problems, both pathological and therapeutical, is being done under the supervision of Dr. Thomas Lewis, who has now accepted a position upon the permanent scientific staff of the Research Committee. Owing to the exigencies of the war this staff has been changed from time to time, but Captain John Parkinson, formerly with Sir James Mackenzie at the London Hospital, Major Meakins of the Canadian Army Medical Corps, and other officers, have done a great deal of good work; first, in invaliding out of the army men with permanent heart affections, and, secondly, in the study and treatment of the cases of so-called "irritable heart."

These patients are first tested by systematic exercises carried on under medical supervision, and then treated by these and similar methods. By these methods, instead of some weeks or months of indefinite invalidism, the cases are cleared up in a month or less; those patients who are not likely soon to be fit to return to service being drafted out, and the return of the more fit expedited. Although this work is rather for utility than for research, yet much research into the nature of these troublesome cases is involved in the system. By means of orthodiascope, polygraph, string galvanometer, pharmacological tests, and so forth, much information of a strictly scientific kind is obtained. Digitalis is found to be useless, or without any good influence, in these "irritable" heart cases, and is, as a rule, discarded. Moreover, Mr. Barcroft of Cambridge has applied his well-known methods of gas analysis to determine the hydrogen-ion concentrations of blood, or at any rate the balance of its reactions, in these cases; researches which suggest that the explanation of the breathlessness may prove to be due to a deficiency of certain salts in the blood of metabolic origin.

I have said that many departments of the comprehensive schemes carefully planned out by the Research Committee before the war have been almost entirely held up. Not only has the staff been surrendered, but everywhere the pathological laboratories are depleted of expert assistants. Too many skilled laboratory attendants, instead of being secured for military laboratories, have been enlisted as combatants. For instance, research into the subject of rheumatic infections—in which I am warmly interested as being a peril of young life almost as dire as the tuberculous—into thyroid perversions, oral sepsis, diabetes, have been, wholly or in great part, suspended for the present. Some work, however, is in progress on the study of acetonaemia; and, more generally, on the urinary excretion of acid, the control of respiration by the mid-brain, and the sensitiveness of the respiratory centre to acidity.

One of the chief original duties of the Research Committee—the investigation of the incidence of phthisis upon particular occupations and industries—has received a good deal of attention. A large number of visits have been paid to boot and shoe factories, leather and hide works, and printing shops. In this research the Statistical Staff also has taken a considerable part. A report on the boot and shoe industry is already published. The evil elements in bad ventilation are being detected, and the changes of the respiratory mucous membrane under changes of temperature recorded. For this and certain other trades special sanatoriums are recommended, so equipped that the patients can be set to work, each on his own trade, under the direction and vigilance of the physicians in charge. Like inquiries are on foot in Birmingham, Bradford, Leicester, Manchester, Sheffield, Cardiff, and Belfast.

At Midhurst, and again under Dr. Gauvain at Alton, and at the Peamont Sanatorium (Dublin), researches are on foot to determine the value of tuberculin treatment. Using the clerical and visiting assistance provided by the Committee, Dr. Bardswell has completed an extensive report, to which the Clinical Prize of the College of Physicians has been awarded. It is hoped that this important manuscript may soon be published. On the types of bacilli in tuberculous infection, especially on the occurrence of bovine and human types respectively in children, work is in progress in the Dublin and Edinburgh pathological laboratories under Professor McWeeney and Dr. A. P. Mitchell; while Dr. Stanley Griffith, at the Field Laboratories in Cambridge, is continuing his well known studies upon the types, the attenuations, and the mutations of the bacillus, and upon bone and joint tuberculosis. Important work on a method much in need of

development—namely, radiography in the diagnosis of phthisis—has had to be suspended.

As regards purity of milk supply, the Committee, with the consent of the Local Government Board, invited Dr. Janet Lane-Claydon to prepare the excellent monograph and critical review of this subject which has had so cordial a reception by our profession; and undertook to pay her fee and the costs of publication. This monograph, it is hoped, may be the first of a series. At Reading Dr. Williams is studying the tuberculous infection of pasture lands by the dung of tuberculous cattle or otherwise. Two cows, apparently healthy in all respects except that tubercle bacilli are contained in their dung, have now been obtained from different sources, and careful experiments, with suitable scientific controls, are being carried out on pastures hired by the Committee. Methods of electrical purification of milk are still under investigation at Birmingham by Sir Oliver Lodge and Professor Leith.

I must not forget the pressing need of farther research on dust inhalation, for which a scheme has been drawn up. You are aware, no doubt, that one seat of these investigations is your own district; that Dr. Mellor is investigating the chemical and physical characters of dangerous dust particles, and Dr. Barwise, in Derby, the pathology of gritstone phthisis. For the farther investigation of this subject and on some aspects of the hygiene and the perils of mining, the Committee has placed the whole-time services of Dr. Mavrogordato at the disposal of Dr. Haldane, whose fruitful researches for the Home Office are too well known to need my commendation.

Some other lines of research, more or less actively in hand under the auspices of the Committee, I must do no more than indicate. For example, in London and the provinces, researches are on foot on the ductless glands, on bacilluria, on diphtheria, on the lipid contents of organs, on the so called status lymphaticus, on the Binet scale for the blind, on the grading of alternative mental tests, and so on. On the surgical side much attention is being given to gunshot wounds of the chest, to skin-grafting on wounds, and to wounds of the brain and of the spine; while a heterogeneous collection of cases under such descriptive names as "shell shock," are, with other functional nervous disorders, under the charge of Professor Mott at the Maudsley Hospital, Denmark Hill, of Major Rowe and Dr. Rivers of Cambridge at Maghull, Liverpool, of Dr. Head at the London Hospital, and elsewhere. At the Neurologists' Conference in Paris, last April, Dr. Head represented the Research Committee, and recommended a certain scheme for the record and organized study of neurological cases. In this department the Committee has been fortunate enough to secure the eminent services of Dr. Sano of Antwerp, who, expelled from his own laboratory, now gives his whole time at Claybury and Denmark Hill. The brilliant work of van Gehuchten, of Louvain, recommenced under like circumstances at Cambridge, was unhappily cut short by his lamented death not long afterwards.

One of the earliest undertakings of the Committee, a scheme of work on rickets, including a study of tetany, and of the thymus and the parathyroids, has been delayed. On another grievous disease however—rheumatoid arthritis—Dr. Strangeways, on a part-time grant, has continued to prepare his reports upon the large bulk of material which for some years he has been collecting at the Cambridge Research Hospital. His report on the morbid anatomy is now being completed by another on the histology of the disease.

I think it only remains for me to say in this part of my address that in one way or another, by grants, plant or personnel, pathological assistance has been given by the Committee to about thirty of the chief military hospitals. Much of the scientific work thus assisted in these centres is no doubt of a routine kind; but in time of war it is impossible to distinguish very closely between routine and research. Indeed, it is often in the course of practical experience that new problems and new lights appear which in the laboratory would never have arisen.

Much more of my discourse was given to a sketch of the outlines of the many and various researches carried on by the staff of the Committee into the nature of disease, and to recognition of many more of its investigators, nearly all of them for full or part time on the staff, or offering facilities as heads of laboratories. As however the report of 1915-16 is now published, it is

needless to reproduce all those paragraphs. In their place let me attempt a brief survey of the general trend and character of the work completed or in progress.

During the war the diseases which command attention are, of course, those belonging especially to armies in the field; namely, the poisoning of wounds by many microbes, aerobic and anaerobic, and the effects of associated conditions, such as the tryptic and antitryptic. Closely upon them follow such inward infections as the various diarrhoeas and dysenteries, including summer diarrhoea and asylum dysentery, their causes, symptoms, and carriers—men, water, flies, etc.—with the corresponding methods of prevention and counteraction, and so on. The great, almost complete, success of vaccination against the several kinds of typhoid fever, and of prophylactic serum in tetanus, have received the verification which confirms the universal impression of all observers; while a new method of disinfecting ships without injury to fittings or decorations, and at a small expense, has proved invaluable in this part of the medical service. On the diseases of civil life, which in the long run are even more destructive to mankind, on such diseases as tuberculosis, rickets, rheumatic fever, diabetes, rheumatoid arthritis, etc., some steady work is in progress, but under the disadvantages of diversion of individual energies, and the depletion of laboratories for the combatant and medical services. Cerebro-spinal fever, "trench fever," "frostbite," animal parasites, have been under continual study.

To make a summary of the methods is a more difficult task. By bacteriological methods, by chemical study, as of colloids, lipoids, alkaloids, enzymes, hormones, catalysts, and of toxins, protein and other, of amino acids, of immunity phenomena and anaphylaxis, of the relation of the saline, carbon dioxide, and other constituents of the blood to muscular, cerebro medullary, and other functions, the secrets of disease are being besieged on many lines, frontal and flanking—lines which it is to be hoped are on the whole convergent. Thus with some dismay we perceive that to organize a campaign against disease from all these directions seems to presume in the inquirer accomplishments which no one man can command. No man can be a clinician, a pathologist, a physiologist, a chemist—and chemistry has now its physical as well as its physiological side—and a physicist; scarcely, indeed, can he master any two of them. This is true; and the need is not, in part of course, by division of labour—but only in part.

Many men, clerks of science as one may call them, work assiduously and intensely at multitudinous small points, and, seeing each his own point and little more, yet do excellent service in accumulating facts under the direction of other and maturer minds. Nevertheless, if a young scientist has the ambition to excel in pathological research he must try ever more and more to see something of the whole. For example, it may be that Ehrlich's hypothesis is now failing to explain all the facts; but if this be so, the hypothesis has been of invaluable service in giving a large imaginative conception of morbid processes, a breadth of view which has lifted up the ideas of all who have followed him. But Ehrlich could not have reached this elevation of outlook had his vision been confined, let us say, to bacteriology. Like Pasteur, he had at least some mastery of the more general ideas of chemistry and physics.

By its hierarchy of workers and choice of methods the Research Committee fosters this breadth of view as well as inquisitiveness and accuracy in detail. If then all research into the nature of disease must radiate from physiology, for all disease is but a perversion of the normal, or a declension from it, the investigator, if he is to be successful, must have some mastery of chemistry and physics also. To the physiologist, indeed, the animal body is but a congeries of microbes, which, from such simple aggregation as in the sponge, becomes so differentiated and combined, both in structure and function, that in the mammalia perhaps no group of cells has escaped construction into organs, as these again are organized in the whole. And each kind of these cell microbes has its own product—that which physiologically we call a secretion or excretion, pathologically a toxin; the difference being one of relative utility. The production, for example, of ptyalin from a salivary microbe is analogous to that of the toxin of a bacterium; the enzyme of a septic organism to that of a pancreatic cell. Trypsin is useful or mischievous according to the sphere of its occupation.

As it is the precious service of the artist or moralist to lift the ideas of mankind into the highest spheres which thought and imagination can reach, or even vaguely discern, so, as one William from Ockham has told us, it is the property, not always delectable, of science to reduce phenomena to their lowest possible categories. Science now boldly asks what evidence we have—evidence likely to resist analysis—of any “suprachemical” mode or modes of energy. Thus it is that no physiological research can be exhaustive unless the student be in possession at least of the ruling principles of chemistry. If not, he may be working on a false bottom, with the chemist mining below him. But this is not all; far from it. Below chemistry comes, as I have said, the physicist, also driving his adits under the chemist, the physiologist, and the pathologist. We have scarcely ceased to admire the phenomena of phagocytosis, and distributed to this function the language of war, when the physicist comes in and shows signs of sweeping the whole “biological” conception of it down into his own category. He tells us, or is threatening to tell us, that these phenomena may be explained by the laws of surface action. And into the same net he is prepared to gather “opsonins,” “agglutinins,” and other phenomena which hitherto had lain quietly in the lap of the biologist. So again, what is to be the interpretation of catalytic functions? What of enzymes? That many catalysts—bodies that is which quicken the rate of molecular disintegration—are inorganic, we know. How much of catalysis then is reduceable to the category of physics? We say sometimes that as in chemistry we expect quantitative relations between cause and effect to be calculable, as, for instance, in the case of certain alkaloidal products of bacteria, and presume therefore that such a function as anaphylaxis, wherein quantitative proportions seem subordinate, must be “suprachemical”; yet do we feel sure that, even here, enzymic and catalytic processes may not prove to have physical explanations as well as physical conditions? We admit that if most enzymes are protein, such is not the case with all of them. Again, the action of lipoids and recent researches upon adsorption carry us down again past chemistry proper to the ground floor of physics. Many strange perversions of the mind of man are explicable by purely physical relations between the nerve cell and some accessory substance outside it. Consider again the drop we have had from animal and vegetable food; “from the life-giving blood,” from the store of courage we were taking in when we ate the heart of a lion, to nourishment by amino acids! One of the most wonderful experiments of the laboratory is the continuing function of the separated heart, fed only by Ringer’s, or Ringer and Lock’s, fluid. In like manner some kinds of dyspnoea seem to be due simply to a faulty crisis of the salts of the blood. And at the other end of the scale we have the relations between bacteria and the amino acids, and the present need for an advance of chemical bacteriology to the commanding position already attained by its morphology.

In medical research then we shall not regard in one set of cells the liberation of hormones as an exceptional endowment, or in another the liberation of a stimulant or catalytic product, and so on; we shall realize that, variously differentiated, some such effluence is the endowment of all cells, from the simple ptyalin of saliva to the toxins of pyogenic or anaerobic bacteria, the ricin of castor-oil or the juice of the poppy; each kind of cell having worked out its peculiar function. The amazing thing is the infinite variety of cell effluence in the animal and vegetable world; a variety presumably potential in the simplest organisms. If for a moment we can imagine in the animal body the secretion of every several kind of cell to be tinted with its own colour, and the tissues to be transparent as glass, we should see from every organ, even no doubt from bone itself, the peculiar dew of each streaming into the passages of the body, mingling into a general iridescence, and yet each, selecting and selected, ministering to its peculiar service of nourishment, integration, reinforcement, degradation, or elimination.]

My desire in this address has been to give some idea of the dimensions and scope of the work in progress by the Committee, and generally in the field of medical research, and some sense of the large and intense vitality of the movement and of the army of workers. In the next twenty years, as in the last twenty, medicine will, we trust, be so

enlarged and illuminated in many directions that the art and the science will again be transformed. And upon these new conceptions, new discoveries, and new auxiliaries will be based a new therapeutics to give us a command over disease as great again as that ascendancy which already has distinguished our own generation.

One pleasant duty remains—namely, to express to you our grateful sense of the really brilliant services, both in organization and in intellectual aid and counsel, of our secretary, Dr. Walter Fletcher. The Committee’s report for 1915–16 is shortly to be published. Both from this and his previous report I have borrowed largely, and in many passages have not hesitated to make direct quotations.

In conclusion, gentlemen, I owe you sincere thanks for your indulgent attention to an address which owes whatever of interest it may contain to its subject, and little or nothing to the speaker.

Abstract of a Lecture

ON

A CASE OF ARSENIC CANCER.

DELIVERED AT THE MIDDLESEX HOSPITAL, 1916.

BY

SIR JOHN BLAND-SUTTON, F.R.C.S.

SURGEON TO THE HOSPITAL

“AUXETICS” is a term applied to chemical and physical agents capable of stimulating epithelial cells to unwonted activity. In pathology the term is more particularly applied to agents that can provoke such changes in epithelium as to predispose them to become cancerous. It has long been known that soot, lime, pitch, tar, arsenic, and caustic soda are auxetics in the stricter sense. To these have been added during the last twenty years *x* rays and radio-active substances such as radium. Chronic ulcers caused by burns and scalds are also liable to become cancerous.

Quicklime is indirectly an auxetic; it burns the skin, and chronic ulcers caused in this way sometimes become cancerous. This change has been noticed in scars on the conjunctiva left by lime burns. Davis published some curious evidence connecting lime with cancer of the cheek occurring in the natives of the Philippine Islands who chew betel nut. This nut is the fruit of the betel palm; slices of the fruit are dried, wrapped with a pellet of lime and an aromatic like cardamoms, or turmeric, in a leaf of the betel vine. This mixture is called buyo. When chewed buyo causes a copious flow of red saliva that dyes the lips and gum, but blackens the teeth. It is supposed to sweeten the breath and stimulate digestion. The practice of chewing betel nut is common in the Philippine Islands. Cancer frequently attacks the mucous membrane of the cheeks of men and women who chew buyo. The natives attribute the disease to buyo chewing. Davis considers the lime to be the essential cause. The lime used for buyo is obtained by burning the shells of molluscs.

Some of you may remember that I showed you, about three years ago, a forearm amputated on account of an extensive cancerous ulcer. The man, aged 69, to whom the arm belonged, was employed to wash telegraph cups in a solution of caustic soda. One day he splashed his arm with the solution, and this caused an ulcer; it never healed. Two years afterwards he came to the hospital with a typical cancerous ulcer, enlarged lymph nodes at the bend of the elbow and in the axilla. The lymphatics along the median basilic vein were so permeated with cancer that I dissected them out like solid cords. On microscopic examination, the tissue around the edge of the ulcer had the usual characters of squamous celled cancer and a lymph node from the bend of the elbow was stuffed with similar material.

The dermatitis caused by *x* rays and radium is, in essence, a chronic ulcer, and, like chronic cutaneous ulcers in general, becomes, by slow and insensible stages, cancerous. As a result of *x*-ray treatment a rodent ulcer may become transformed into a squamous celled ulcer. A woman, aged 50, under my care had an ulcer involving the skin of the lower eyelid. The ulcer was excised and examined microscopically; the appearances were those